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Director,  
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JAN 15 1999

FEDERAL COMMUNICATIONS COMMISSION  
WASHINGTON, D.C. 20544

January 15, 1999

Ms. Magalie Roman Salas  
Secretary  
Federal Communications Commission  
445 Twelfth Street, S.W.  
Washington, DC 20544

**EX PARTE NOTICE**

Re: **Ex Parte Presentation, Deployment of Wireline Services  
Offering Advanced Telecommunications Capability  
FCC Docket No. 98-147; Inquiry Concerning the Deployment  
Of Advanced Telecommunications Capability to All Americans  
in a Reasonable and Timely Fashion CC Docket No. 98-146**

Dear Ms. Salas:

Pursuant to Section 1.1206 of the Commission's rules, this letter, which includes two copies for each referenced proceeding, is notification that on January 13, 1999 representatives of Nortel Networks met with the following FCC personnel concerning issues in the referenced proceedings: Linda Kinney, Office of Commissioner Ness; Paul Misener, Office of Commissioner Furchtgott-Roth; Paul Gallant, Office of Commissioner Tristani. At the meeting with Ms. Kinney Gary Bolton, Senior Business Manager External Relations and the undersigned represented Nortel Networks. At the other meetings Wayne Getchell, Director Subscriber Access Solutions also represented Nortel. Martha Carucci, Manager Government Relations-Telecommunications also represented Nortel Networks at the meeting with Mr. Misener.

Enclosed for inclusion in the records of these proceedings are the written materials that were provided to the FCC meeting participants and on which Nortel's presentations were made.

If you need additional information, please communicate with the undersigned.

Sincerely,

Raymond L. Strassburger  
Director, Government Relations-Telecommunications Policy

No. of Copies rec'd 2 copies  
List ABCDE

**Enclosures**

cc: Linda Kinney, Office of Commissioner Ness  
Paul Misener, Office of Commissioner Furchtgott-Roth  
Paul Gallant, Office of Commissioner Tristani

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**NORTEL NETWORKS**  
**Commission Steps to Ensure the Availability of**  
**Advanced Services to All Americans**

Nortel Networks shares the goal of the Commission and Congress in facilitating the timely, robust, competitive and ubiquitous deployment of Advanced Services in the United States. In this manner, all Americans can enjoy the manifold benefits of high-speed access to the Internet.

The technology exists today for making these services available, but the Commission must be vigilant to avoid creating, and affirmatively remove, artificial regulatory barriers to the economic deployment of these services.

In order for this vision to become a reality, the Commission must ensure the participation in the marketplace of three sets of entities – the Incumbent Local Exchange Carriers (ILECs), the Competitive Local Exchange Carriers (CLECs) and the Equipment Manufacturers.

There are affirmative steps the Commission should take in its Section 706 Proceedings and elsewhere that will allow each of these stakeholders to contribute to a vibrant market for Advanced Services:

**ILECs:** the Commission should permit these carriers to deploy integrated solutions that allow these carriers to pass along to their customers the full benefits of using the embedded infrastructure. Any separate subsidiary requirement should not mandate the use of separate facilities, but instead should incorporate non-structural safeguards, including virtual collocation via integrated voice/data cards.

**CLECS:** the Commission should ensure that these carriers can compete in the provision of Advanced Services by requiring that non-loaded unconditioned loops be made available promptly by the ILECs. In addition, to allow CLECs to provide integrated Advanced Services, the CLECs should be permitted to physically collocate integrated switching/multiplexing equipment, and “loop share” when virtual collocation through integrated voice-data cards is employed.

**Equipment Manufacturers:** the Commission should revise Part 68 to accommodate the new technology for Advanced Services and ensure compatibility between these Advanced Services and existing services. In the meantime, the Commission should promptly grant waivers of Part 68 provisions when the manufacturer demonstrates that the equipment is compatible with current services.



# **NORTEL NETWORKS**

## **Section 706 Deployment of Advanced Telecommunications Services**

**Gary Bolton  
Data Access Solutions**

**January 13, 1999**

# Nortel's NPRM Filed Comments

## *September 25 filed comments:*

### **1 Deployment of Integrated Switching Equipment**

- There should be no regulatory impediments to the deployment of switch integrated solutions

### **2 Co-location of Integrated Switching Equipment**

- Co-location of Integrated S/W equipment permitted

### **3 Loop Access**

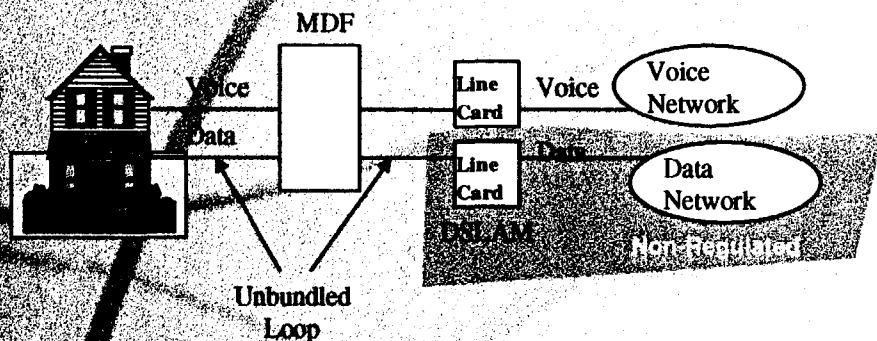
- Access to loops is critical to competition in general as well as the deployment of xDSL type services. Unconditioned loops are readily identifiable and should be made available

### **4 Grant Part 68 Waivers**

- Under circumstances appropriately defined by the Commission, the FCC should grant waivers of Part 68 for xDSL type products

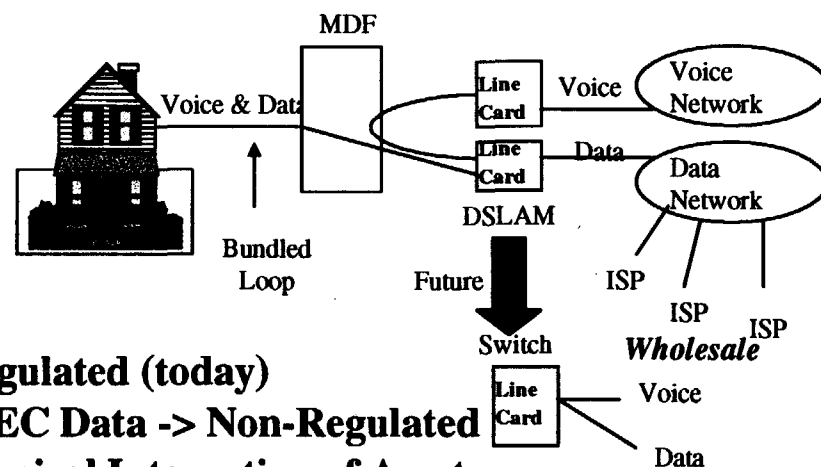
# Integrated Switching - Separate Affiliates Scenarios

## Separate Affiliate Model



- Non-Regulated
- Separate Data Affiliate &
- Physical Separation of Assets

## Integrated Wholesale Model

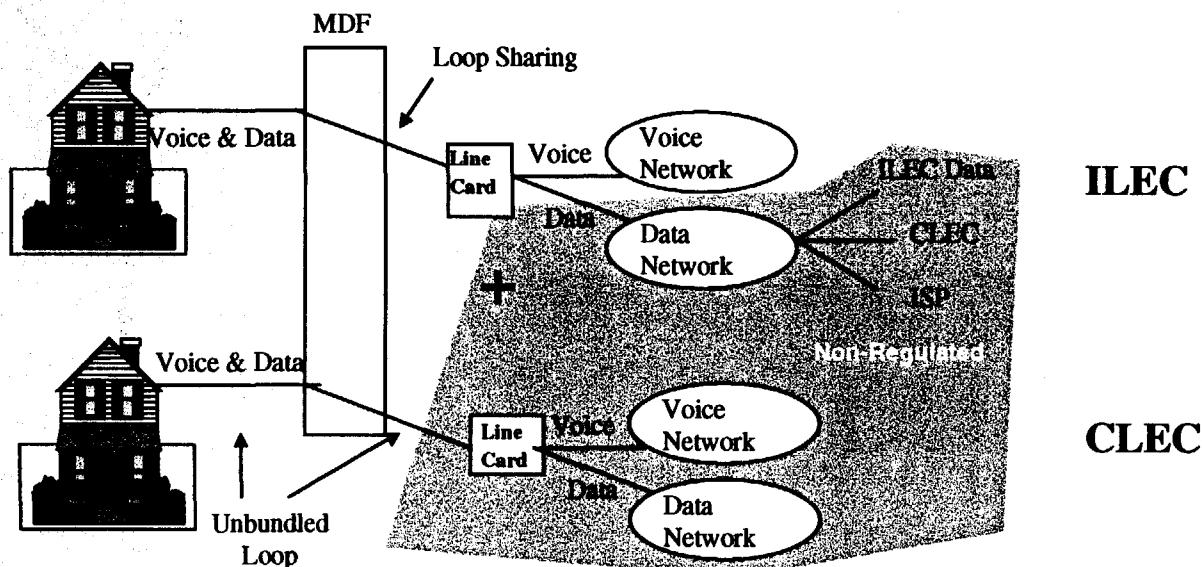


- Regulated (today)
- ILEC Data -> Non-Regulated
- Physical Integration of Assets

## Ideal Scenario

Stumbling Blocks are:

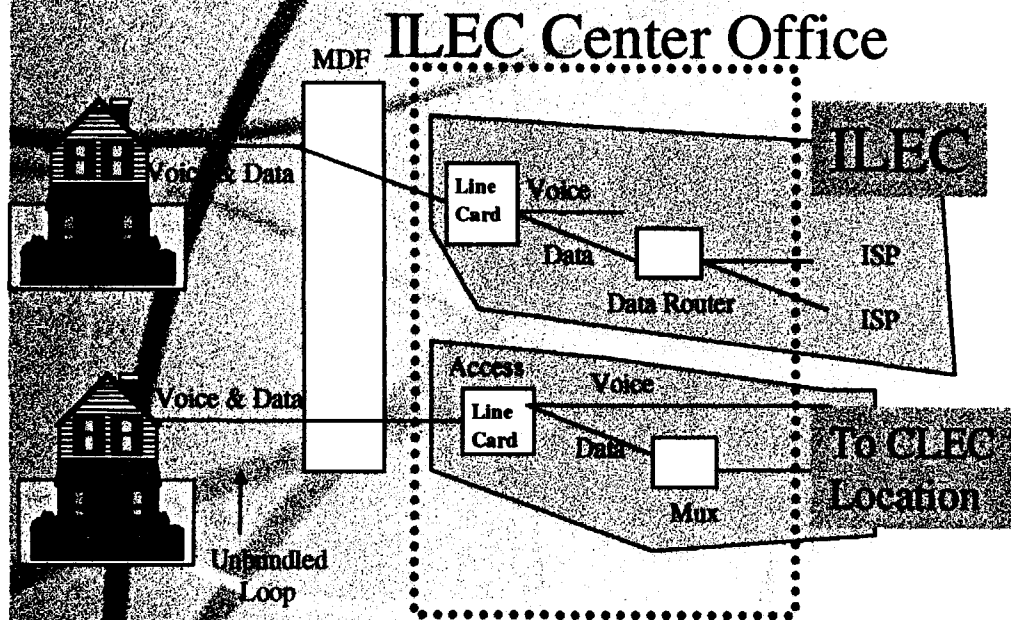
- Physical Separation of Assets
- Resale Concerns of ILECs



- Non-Regulated Data
- No Physical Separation of Assets

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# Collocation of Switching Equipment



## Current Situation

ILEC's ability to provide service to its customers is currently limited by the current situation. The current situation is that the ILEC's are not allowed to provide service to their customers in a way that is not consistent with the current situation. This is because the ILEC's are not allowed to provide service to their customers in a way that is not consistent with the current situation.

## Suggested Policy

The suggested policy is to provide service to its customers in a way that is not consistent with the current situation. This is because the ILEC's are not allowed to provide service to their customers in a way that is not consistent with the current situation.

# Loop Access

## Loop Access Barriers

- Nortel has sold nearly a 1 Million xDSL (1-Meg Modem) Lines
- US Deployment is slow
- No cooperation on loop plant engineering.
- Excessive loop conditioning slows availability and drives up cost.

*Deployment of Advanced Services are constrained*

**Nortel NPRM comments categorized copper loops as follows:**

**"unconditioned" loops**

Are loops which have no capacitive or inductive devices (such as loading coils) on them, regardless of loop length. These are readily identifiable

**"qualified" loops**

Are loops which require special conditioning or engineering to meet more stringent requirements.

*Unconditioned loops should be readily available at the lowest cost*

# FCC Part 68 - Spectrum Compatibility

## Issue:

Service Providers need to protect the Network from damaging "unfriendly services"

- FCC Part 68 does not allow for Advanced Services technology today

## Recommendation:

- Part 68 should be revised to accommodate the new technologies for Advanced Services and ensure compatibility between these Advanced Services and existing services
- In the interim, waivers should be granted to Advanced Services products when Manufacturers demonstrates that the equipment is compatible with current services

# Unbundled Loops & Data Performance

Central  
Office

68% of loops  
Up to 12 Kft  
Unconditioned

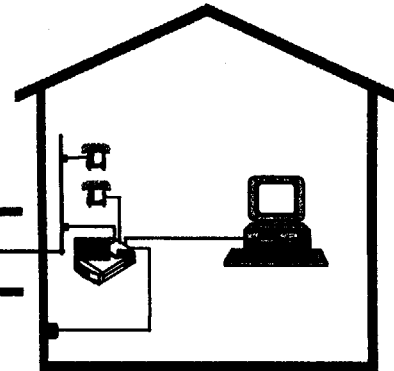
24% of loops  
12 - 18 Kft  
Qualified

8% of loops  
Over 18 Kft  
Unavailable

Non-loaded Loops

1-Meg Modem deployment on unconditioned loops

1-Meg Modem Deployment Standards



Loop Record (Kft)	Actual Rates (Kbps)		Bridge Tap	Interferers
	D/S	U/S		
6.1	960	120	0	None
6.3	960	120	1 (-381 ft)	Damaged Outside Plant
10.1	960	120	1 (-387 ft)	None
9.3	960	120	1 (-131 ft)	ISDN Interferer
12.0	960	120	0	ISDN Interferer
13.2	960	120	1 (-1607 ft)	Damaged Outside Plant
14.6	960	120	0	None
14.0	320	40	0	Load Coil
14.5	320	120	1 (-947 ft)	ISDN Interferer
16.2	640	120	0	AM Transmitter
16.7	640	120	0	HDSL Interferer
17.9	640	120	0	None
25.3	80	40	0	None
27.7	80	40	0	None

1-Meg Modem can address consumer lines without line conditioning

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*How the world shares ideas.*

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# **Policy Recommendations for Volume Deployment of Advanced Services**

Gary Bolton  
Nortel Networks

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## **Executive Summary**

This paper summarizes Nortel Networks' recommendations on the direction that the FCC should pursue for setting policy in the NPRM proceedings. The following discusses our view on the guidelines for successful volume deployment of Advanced Services and our recommendation on the appropriate model to speed availability and promote competition.

## **Policy Recommendations for successful deployment of Advanced Services**

1. Policies must allow Network and Services providers to deploy the most cost effective and efficient architectures to ensure that the FCC can realize the following results:
  - Accelerate the availability of Advanced Services to all Americans
  - Ensure that Advanced Services can be offered at the lowest possible prices so that these services are affordable to all Americans
  - Enable cost structures that allow Network and Services providers to deploy Advanced Services to rural schools, libraries and consumers that would otherwise be excluded in the service area footprint due to business case economics
  - Foster competition by allowing both Incumbents and new entrants to sustain viable business cases
  - Allow Network and Service providers to deploy efficient and cost effective products and to be able to leverage all the features, functionality and capabilities of their capital investments.
  - Maximize the use of the embedded infrastructure, rather than requiring duplication of plant, facilities and operations
2. Policies must provide a level playing field to promote and encourage competition.
3. Policies must ensure that Advanced Services are compatible with existing and future services deployed in the Network, i.e. do not cause interference
4. Policies must not penalize or constrain innovative Advanced Service products, technologies and architectures which speed deployment, lower cost, increase performance and are more network friendly.
5. Policies must require that facilities such as non-loaded "unconditioned loops" be made immediately available upon request at the lowest possible cost.

Nortel believes that these requirements are critical to speeding volume deployment, availability and affordability of Advanced Services to all Americans. Our NPRM comments and ex parte meetings to date have been based around the following four areas which are fundamental to these requirements:

## Summary of Nortel's NPRM Comments

### 1. Deployment of Integrated Solutions

- There should be no regulatory impediments to the deployment of efficient Integrated Solutions which leverage the existing loop plant and equipment infrastructures

### 2. Co-location of Integrated Switching Equipment

- If equipment used to provide access to unbundled network elements has additional functionality such as switching, this functionality may be turned on and used for that capability

### 3. Loop Access

- Access to loops is critical to enabling competition and the deployment of Advanced Services. Non-loaded, unconditioned loops are readily identifiable and should be made immediately available upon request.

### 4. Grant Part 68 Waivers

- Under circumstances appropriately defined by the Commission, the FCC should grant waivers of Part 68 for Advanced Services CPE.

Nortel's four fundamental areas of concern are rooted in basic economics. Cost to the subscriber is a significant market factor. We strongly believe that regulatory policy must foster the most cost effective and efficient architectures and deployment options to speed deployment and availability of Advanced Services to all Americans. The growth of competition is directly impacted by new entrants' ability to sustain viable business cases. Incumbents are less likely to deploy services and cooperate if the regulatory environment unfairly allows competitors to benefit from the Incumbent's infrastructure investment without incurring associated risk.

In the diagrams below, two different ILECs have chosen different Advanced Services deployment models in response to their perspective views on the direction of the FCC policies.

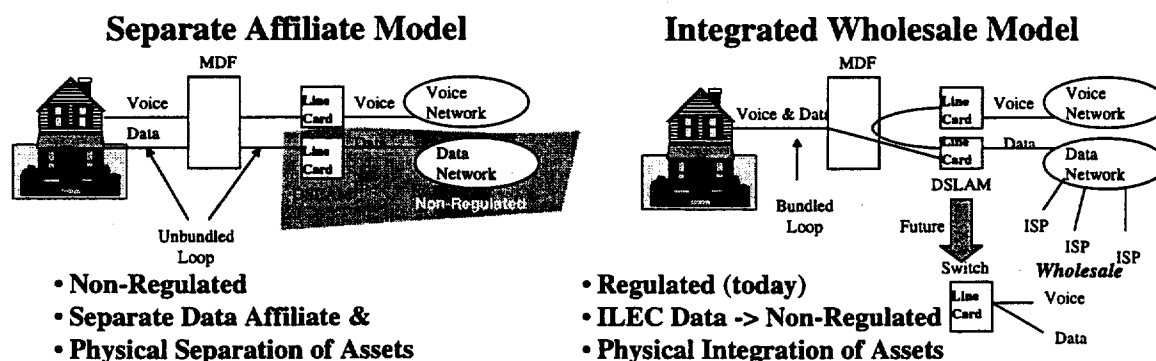


Figure 1

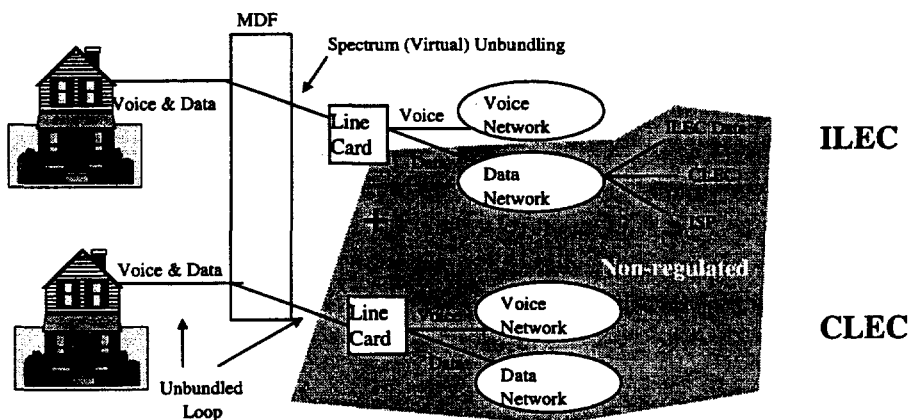
In the Separate Affiliate Model, the ILEC has elected to establish a separate Data Affiliate and establish a physical separation of assets. This model requires the ILEC

Data Affiliate to operate under the same environment and rules as a CLEC to gain access to unbundled loops and co-location space. From a level playing field perspective, the ILEC Data Affiliate faces the same constraints as a CLEC. However this model creates significant economic inefficiencies. Not only is the separate affiliate required to duplicate facilities and operations, a new loop is required for every Advanced Service subscriber. This will result in more costly deployment than necessary and the availability of Advanced Services will eventually be severely limited by exhaustion of the available loop plant.

The Integrated Wholesale Model makes very efficient use of the loop plant (voice and data are carried over the same loop), capital equipment and operations. The ILEC, in this model, avoids having to unbundle network elements by managing the access and providing the service at wholesale to its Data Affiliate ISP and other competitive ISPs. This is a regulated service and the access cost is passed along to the ISP. This model sets a price floor to the subscriber since the ISPs must pass along this access cost and compete on the incremental service price. In this model, CLECs are still limited to requesting unbundled loops and are usually not allowed to co-locate switching equipment. As a result, there is no incentive to lower the access cost.

In efforts to maximize economics and promote competition, Nortel recommends that the FCC policy enable the following deployment model.

## Fully Integrated Model



- **Non-Regulated Data**
- **No Physical Separation of Assets**
- **Co-location of Integrated Switching Equipment**
- **Promotes Competition**
- **Maximum Economic Efficiency**
- **Maximum Leverage of Loop Plant and Facilities**

Figure 2

The fully integrated model allows both the ILEC and CLEC to obtain the maximum network efficiency at the lowest possible deployment cost. Both the ILEC and CLEC

can maintain the integrity of their full access infrastructure and can gain the maximum return on their capital investment by leveraging all the vertical functionality and capabilities of their equipment.

In this arrangement, if a CLEC is providing only the data service to the subscriber and the voice service remains with the ILEC, the CLEC gains access to the data channel component of the local loop through what amounts to loop sharing. Conventional virtual collocation can be used to install the integrated voice-data line card into the Incumbent's existing loop access equipment (switch peripheral or DLC). Loop sharing is enabled by the integrated voice-data line card inserted into the Incumbent's existing access equipment. If the CLEC wishes to provide both voice and data service to the subscriber over the same loop, in order to be at equipment cost parity with the ILEC, the CLEC must be able to collocate the same integrated switching multiplexing equipment for the voice-data line card as the ILEC uses.

The fully integrated model means Americans will significantly benefit through the lowest possible prices and widest possible availability of Advanced Services.

Two further elements are key to the success of this model. The first is to ensure that non-loaded, unconditioned loops are provided immediately upon request. Nortel has provided the FCC with significant data that products and technologies are currently available that are robust enough to be deployed on unconditioned loops.

The other key element is that the FCC must ensure that the integrity of existing and future of services in the network are protected from interference and damage from non-compatible services. By establishing spectral compatibility standards and issuing Part 68 waivers to products that are deemed to be network friendly, the FCC can alleviate many of the issues which will slow the deployment of Advanced Services.

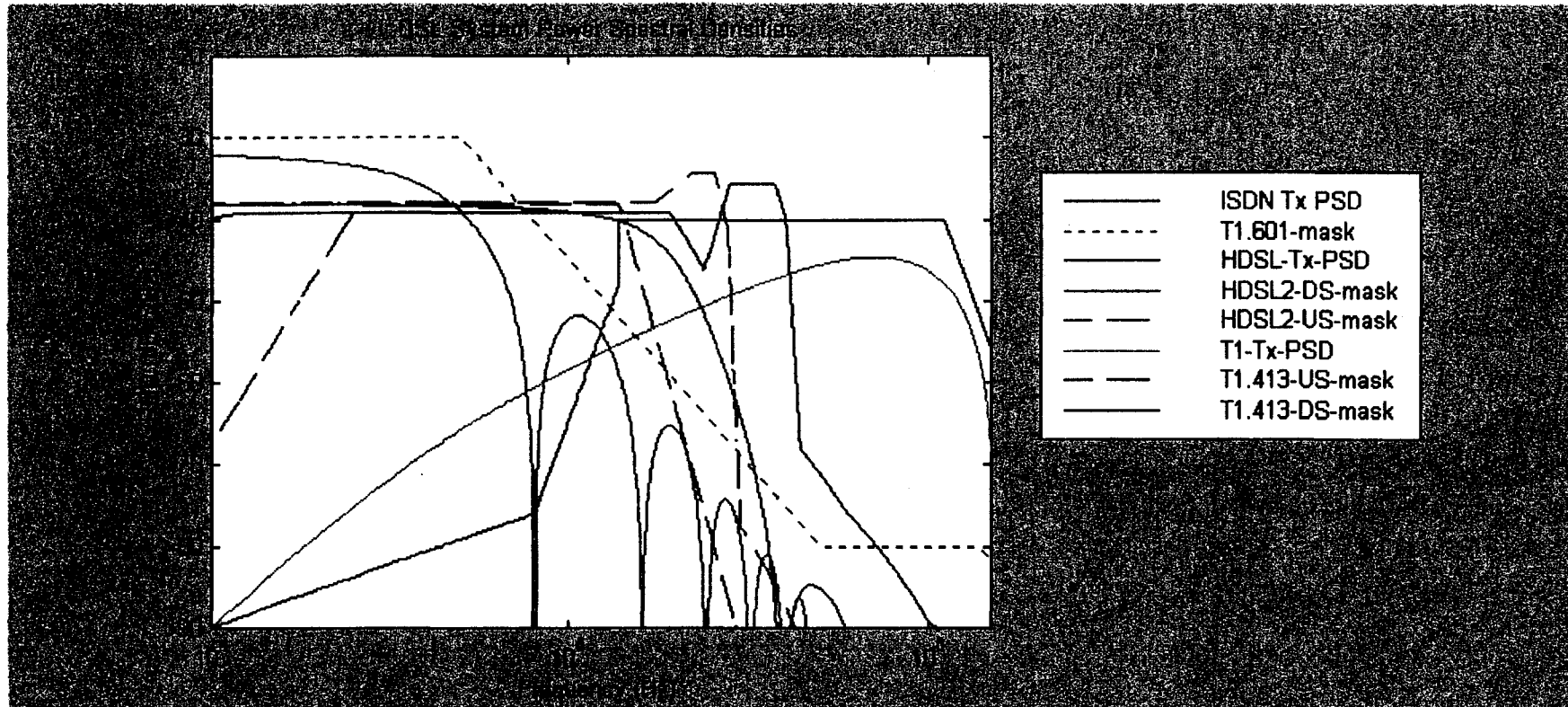
In summary, Nortel strongly supports the FCC's efforts in accelerating the deployment and availability of Advanced Services to all Americans. We strongly believe that to speed deployment, promote competition and to make Advanced Services available and affordable to all Americans, the FCC must carefully consider the network economics that will result from the regulatory policy.

## Types of digital transmission systems.

Two classes of digital transmission systems can be defined.

- NEXT-limited systems use the same transmit spectrum and power in both directions of transmission. This can be done using one pair for each direction, such as T1, or using bi-directional transmission with the use of an echo-canceller, such as ISDN or HDSL.
- FEXT-limited systems use techniques such as frequency-division or time-division to prevent interference from adjacent local transmitters and suppress the NEXT influence. Examples of such systems are G.Lite and ADSL when operating in FDD mode as well as the Japanese version of ISDN.

FEXT-limited systems will still be subject to NEXT from other types of services and they may take advantage of the variation in noise levels across different installations by being rate-adaptive.

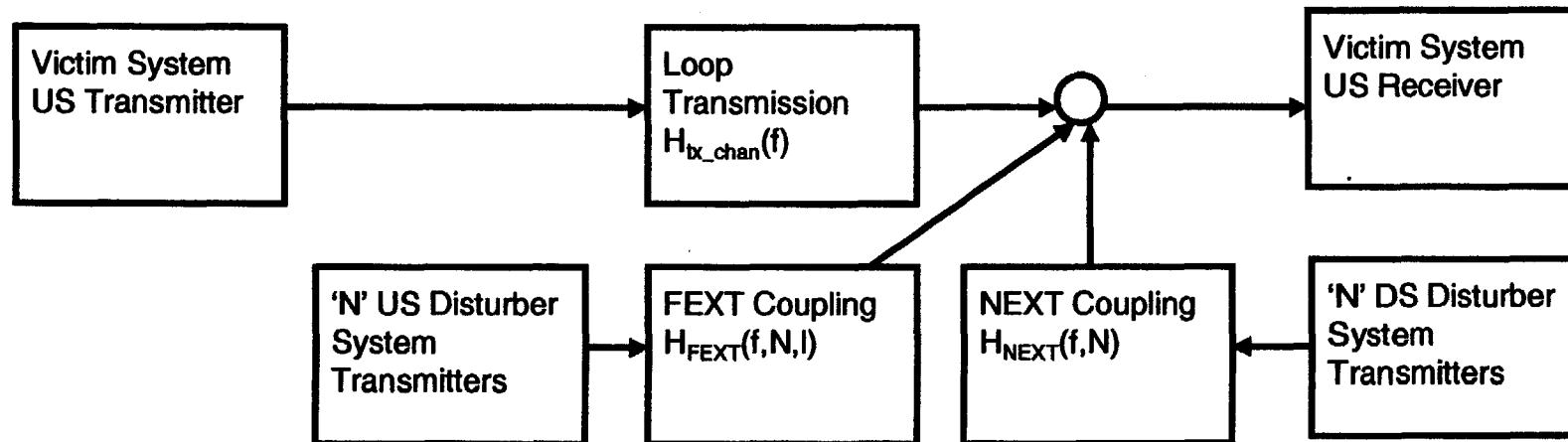


**Spectrum management complicated by a plethora of distinct and less than compatible signal spectra**

## **Based on**

- standard methods for cable modeling
  - as concatenated two-port sections with parameters derived from RLGC primary cable constants
- scenarios for xDSL system deployment
  - e.g. HDSL for business users in CSA range; splitterless ADSL for residential users, with high loop coverage
- industry-standardized models for crosstalk coupling
  - with Nortel Networks extension for more realistic (less optimistic) far-end crosstalk (FEXT) configurations
- evaluation of standards-based PSD masks as candidates for rulings on spectral compatibility
- definition of standard deployed and emerging xDSL system receiver models for performance benchmarking
  - ISDN, HDSL, T1, full-rate (T1.413) FDD DMT ADSL, splitterless (G.992.2 (G.lite)) FDD DMT ADSL

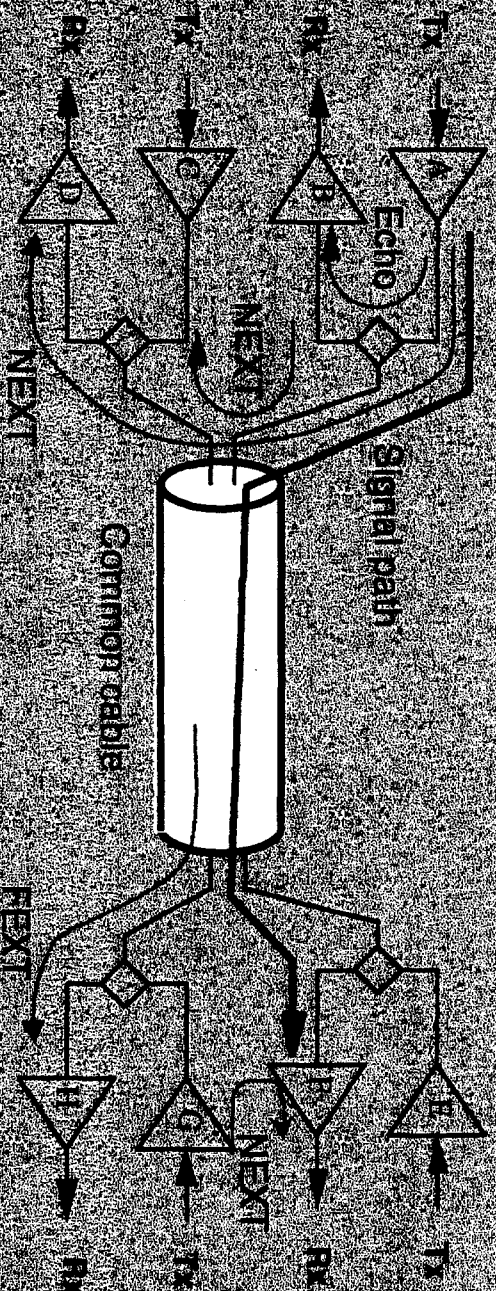
# Overall Model: Upstream Case



- **Victim systems use defined receiver models**
- **Disturber systems incorporate standard PSD masks for evaluation of their suitability as a measure of spectral compatibility**

# NEXT FEXT& Echo

**NO**RTTEL  
NETWORKS

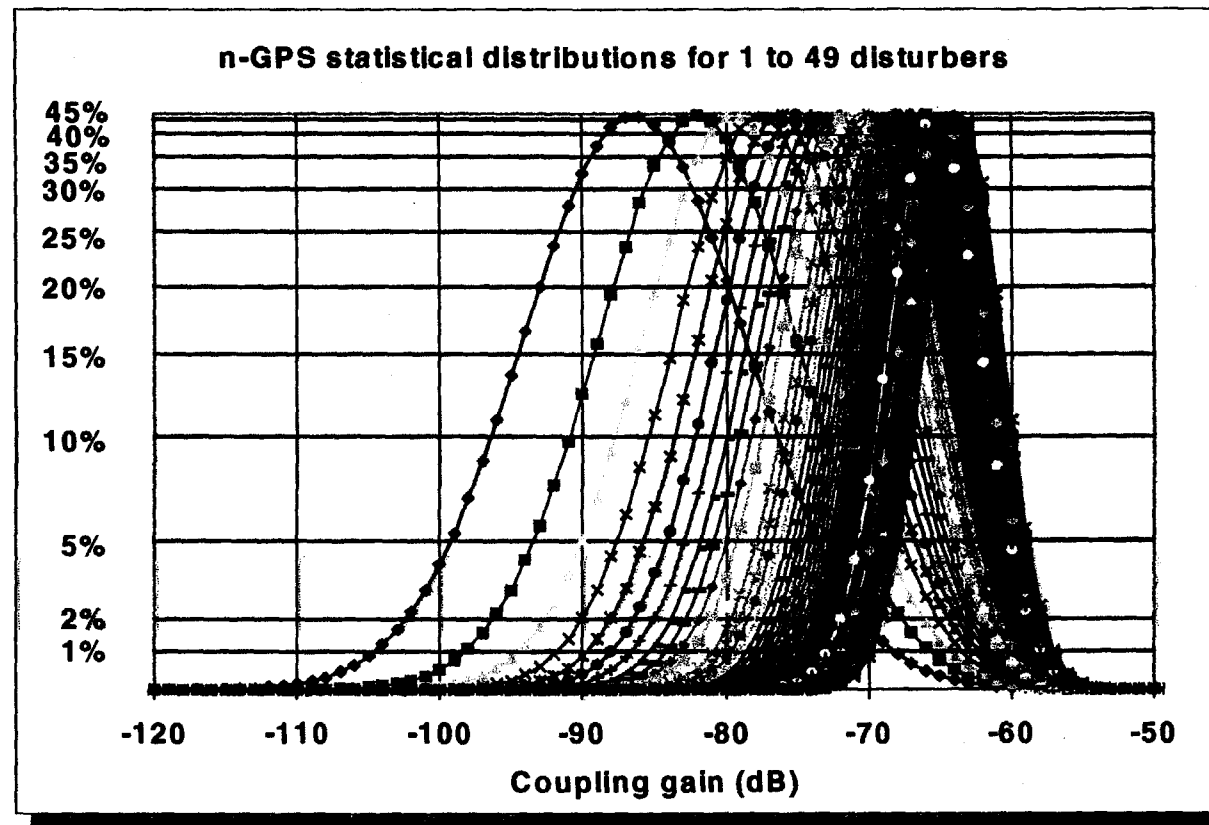


**Signal path:** Path over which the signal travels from the transmitter to the receiver.

**Echo:** Signal present at a receiver input and originating from the transmitter located on the same unit. It needs to be suppressed by trans-hybrid loss, filtering, or echo cancellation circuits.

**NEXT:** Near-End crosstalk, interference introduced by the coupling of output signals from co-located transmitters onto the pair used by the local receiver.

**FEXT:** Far-End crosstalk, interference introduced by the coupling of output signals from foreign transmitters onto the pair used by the local receiver.



**1% worse-case crosstalk model employed to allow for**

- robust deployment with minimum of loop engineering
- extended reach
- other impairments (AM radio ingress, in-home wiring, impulse noise, ...)

## Definition of harm to the network.

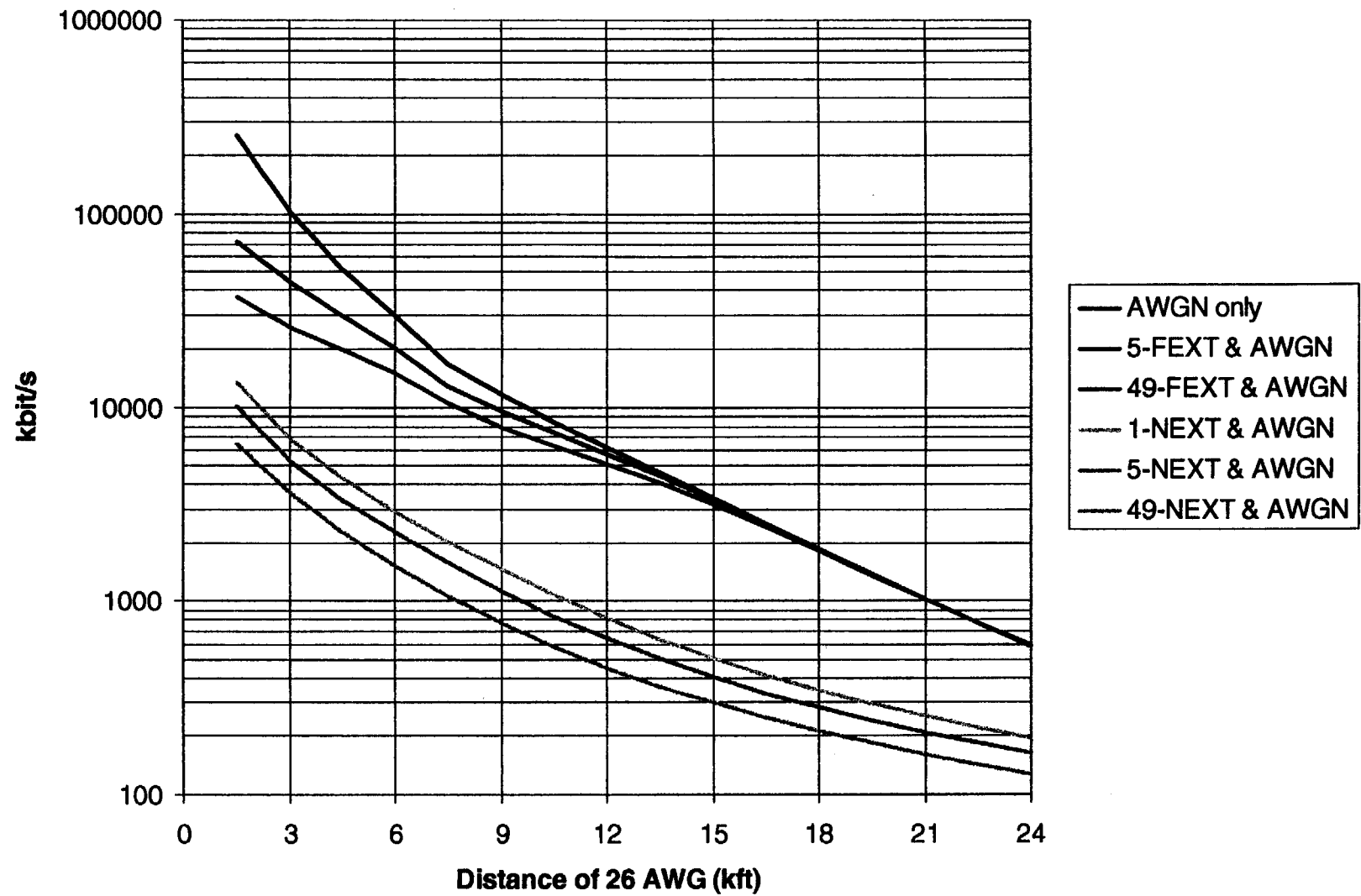
Harm to the network can be defined as *an excessive degradation in performance experienced by an incumbent system resulting from the introduction of another system.*

This definition recognizes the fact that the deployment of additional digital transmission services always affects existing services even when they are spectrally compatible.

In the case of NEXT-limited systems, degradation is a drop in the receiver signal-to-noise ratio exceeding the drop caused by the addition of one more line of the same system.

In the case of FEXT-limited systems, degradation is a failure of one line of the installed system to operate at the stated minimum data rate when one or more lines are equipped with the other system.

**Theoretical maximum data rate vs distance**



The next chart defines the maximum theoretical data rate to be expected from a Digital Subscriber Line (DSL) under the following assumptions and for the cases of FEXT-limited and NEXT-limited operation.

- Using 512 channels from DC to the highest frequency in all cases
- High data rates use 40 kHz channels up to 20.44 MHz
- Medium data rates use 10 kHz channels up to 5.11 MHz
- Low data rates use 2 kHz channels up to 1.022 MHz
- Each channel using QAM at 0 to 15 bits/Hz based on S/N
- 6 dB margin included without coding gain
- No other impairment than NEXT, FEXT, and AWGN at -140 dBm/Hz
- No allocation for the DMT cyclic prefix
- Assuming perfect time-domain equalization, no ISI
- All transmitters and interferers using a -40 dBm/Hz output level
- Perfect rejection of out-of-band noise at the receiver
- Using 99% worst case NEXT and FEXT coupling losses
- FEXT-limited curves use all the spectrum for one direction only
- NEXT-limited curves assume that all frequencies suffer from NEXT

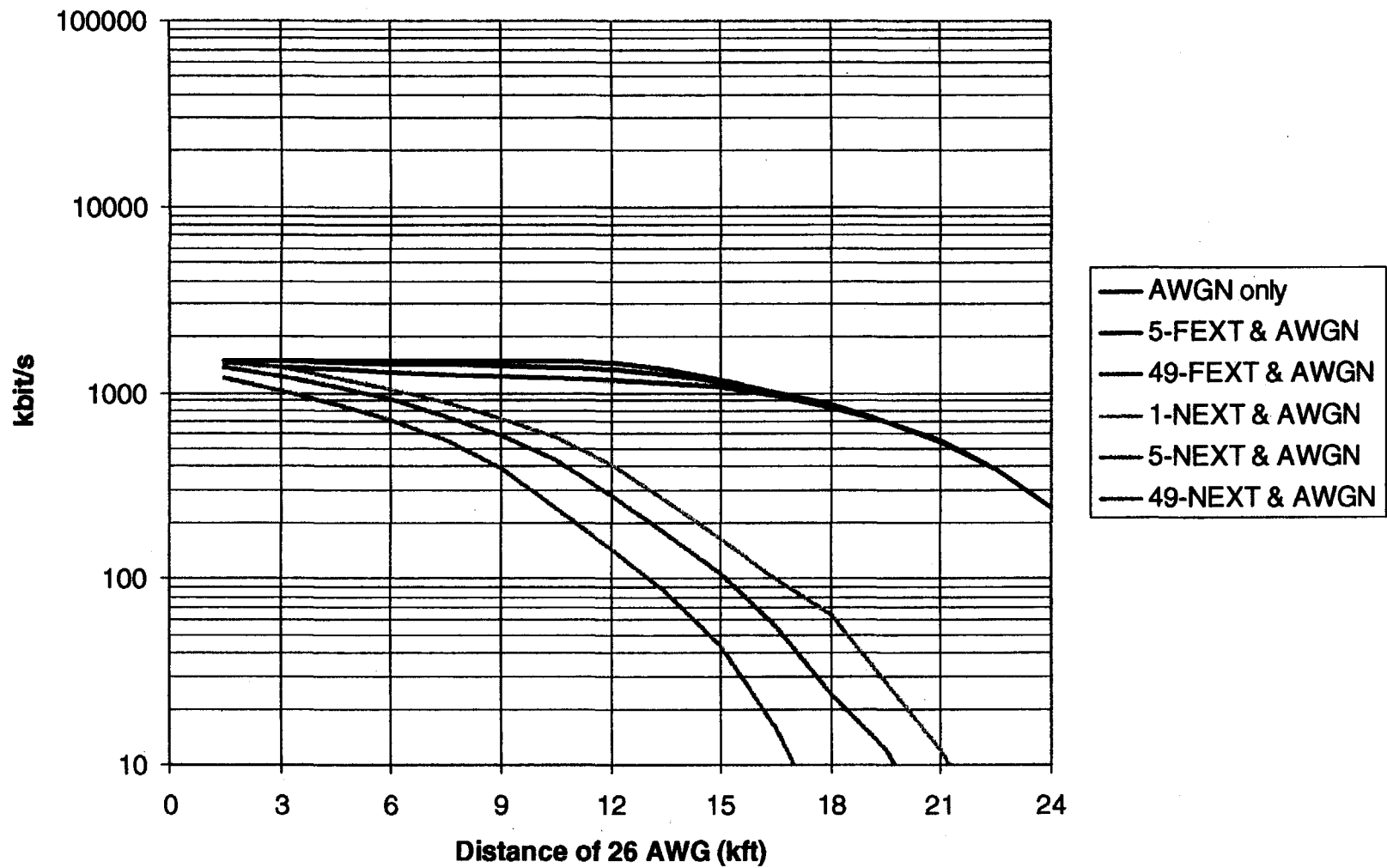
The following two charts show the performance of the same system with the remaining channels divided among the upstream and the downstream directions using the same rule as G.Lite or FDD-mode ADSL. This is indicative of the data rates achievable in either direction of a FEXT-limited frequency-domain-divided ADSL system.

It shows that the assignment of the lowest frequency components to the upstream direction has makes the downstream direction much more susceptible to NEXT noise over long loops.

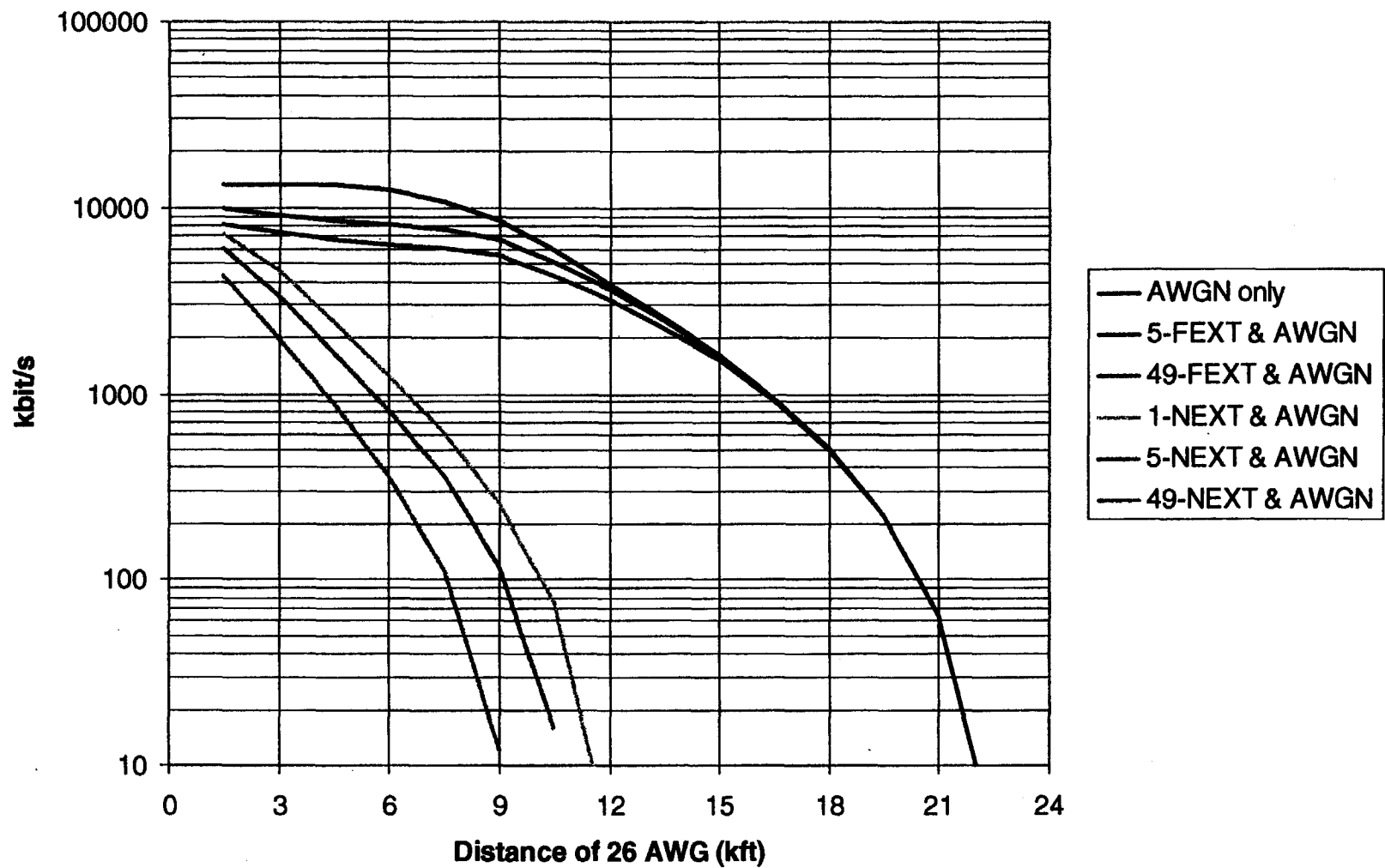
These two charts indicate the potential effect of lack of spectral compatibility between ADSL and other systems. The performance would migrate from the FEXT curves to the NEXT curves and the maximum reach could drop as low as 7.5 kft for line rates in excess of 100 kbit/s.

It might be tempting to operate the ADSL system in a non-frequency divided mode to avoid that problem, but then the impact would be on the upstream direction which would become NEXT-limited by default.

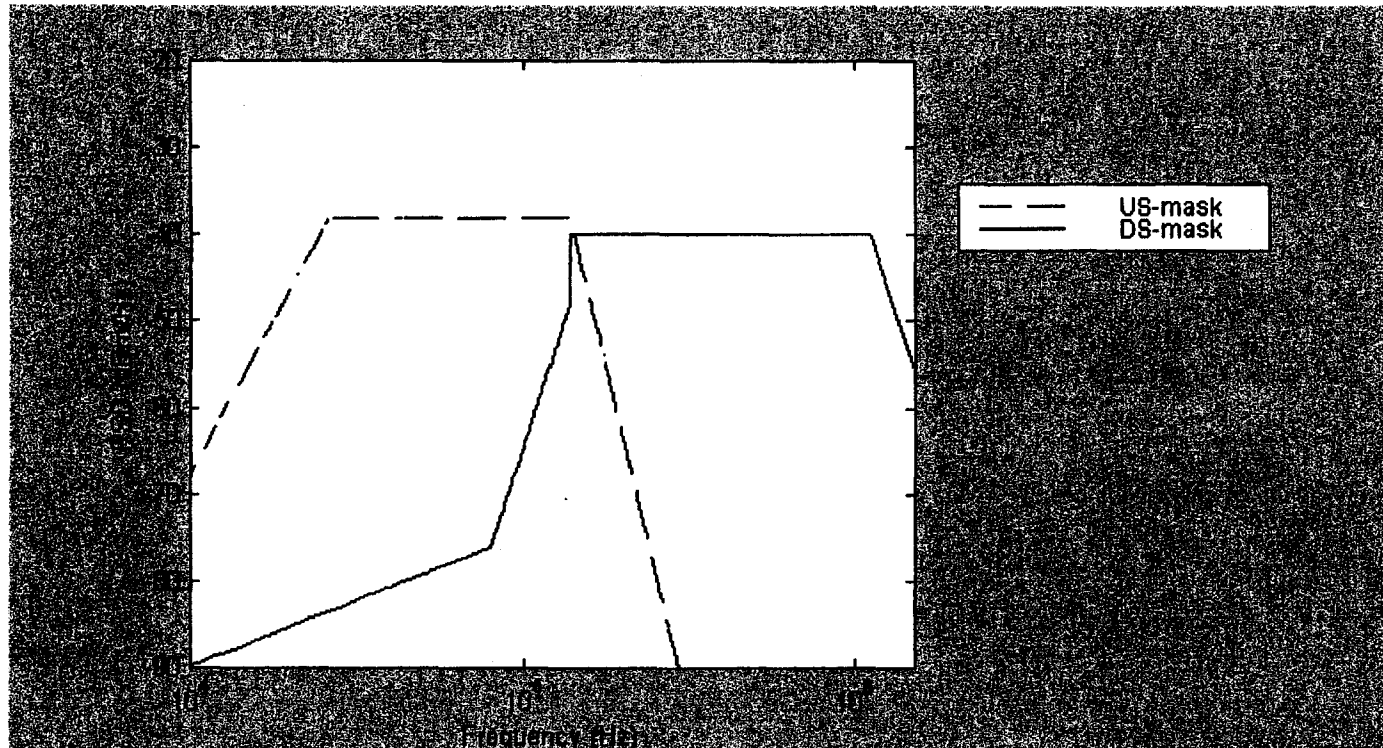
# Theoretical maximum data rate vs distance Channels #7 to #31



# Theoretical maximum data rate vs distance Channels #32 to #255



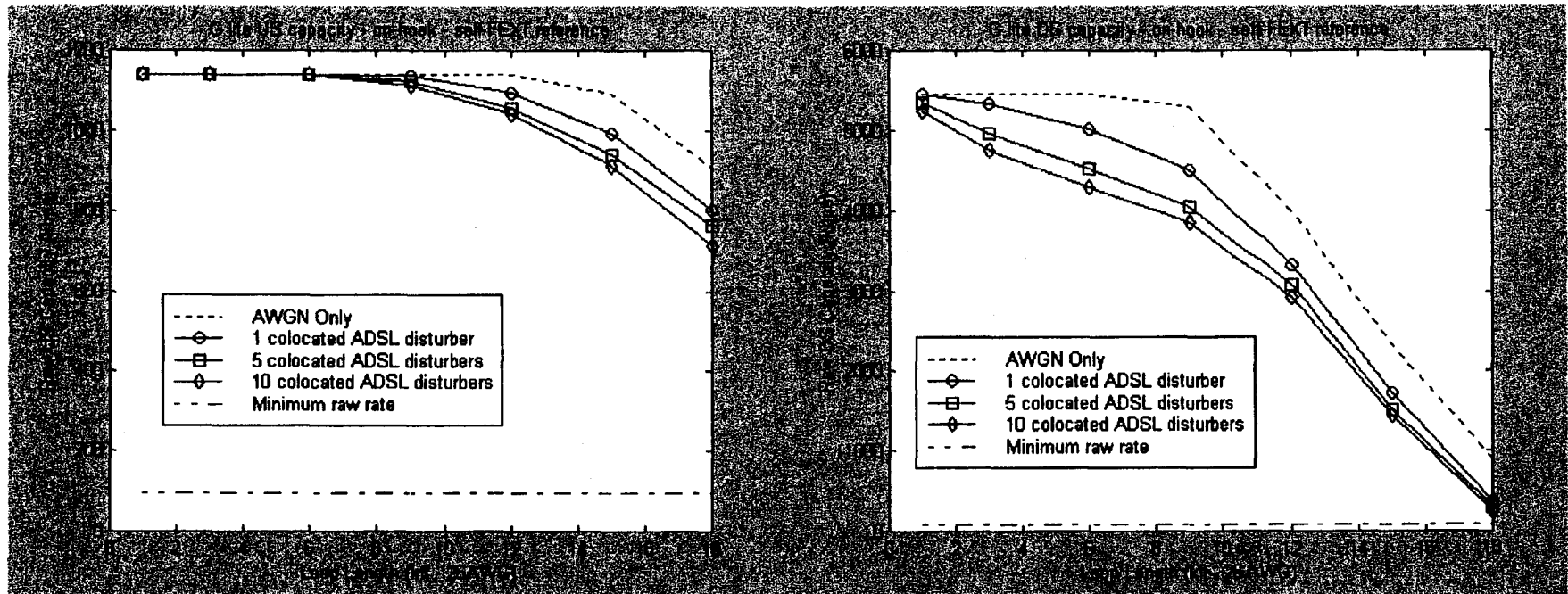
# *Designing for Spectral Compatibility*



**DSL systems designed to operate in a FEXT-limited environment, meeting common upstream and downstream PSD masks, optimize use of the loop plant and avoid complicated spectrum management practices**

- **G.lite FDD DMT ADSL - G.992.2**
  - margin - 4dB (G.lite)
  - mis-equalization noise (ISI) insignificant
  - 3dB coding gain
  - user data rate == raw capacity less 32kbps for framing and the lesser of 32 kbps or 10% for FEC overhead
    - the minimum user data rate of 32kbps corresponds to a minimum raw data rate of 96kbps
  - 7 carrier (~30kHz) separation between US and DS bands
  - maximum constellation size 15 bits/carrier
    - some vendor equipment may only support up to 8 bits/carrier
  - -140dBm/Hz AWGN noise floor

# Reference disturber condition for G.lite

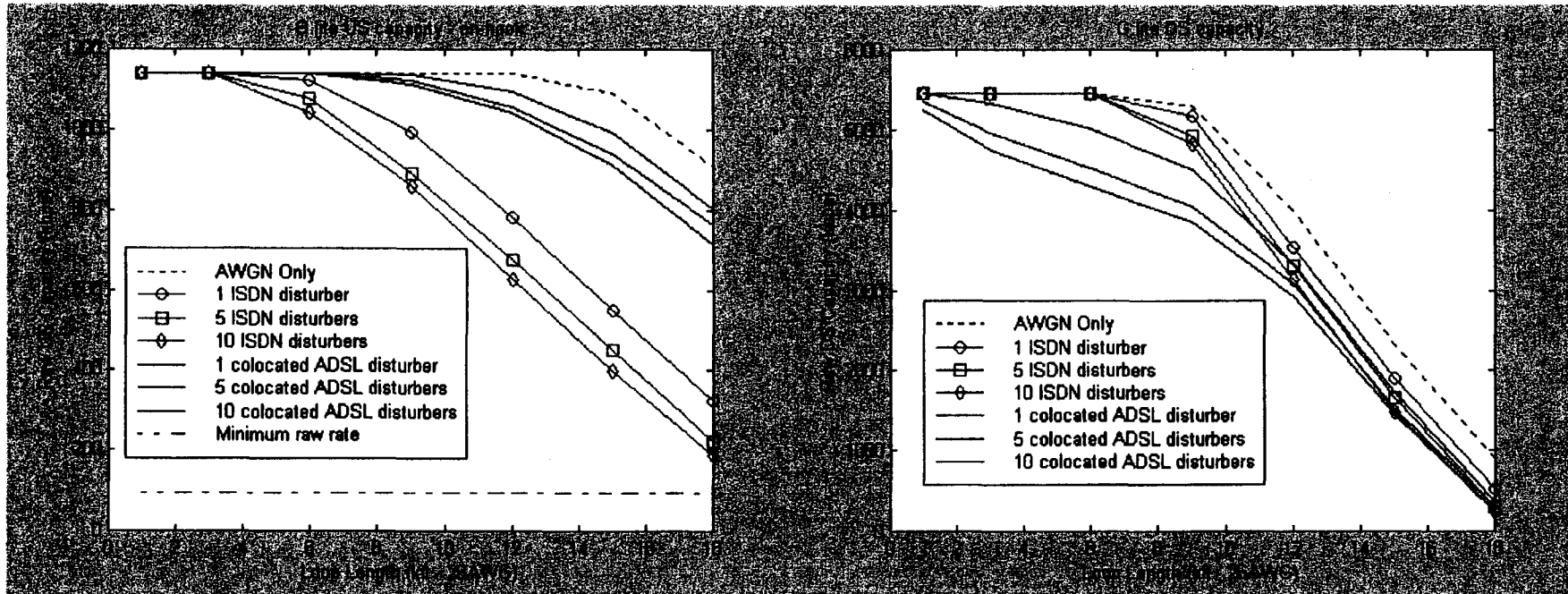


**The reference condition against which all disturber types are evaluated - for impact on G.lite service - is that of G.lite disturbers**

**In this case, we consider the case where the G.lite victim system is operating at full-power (on-hook and/or splitterless operation).**

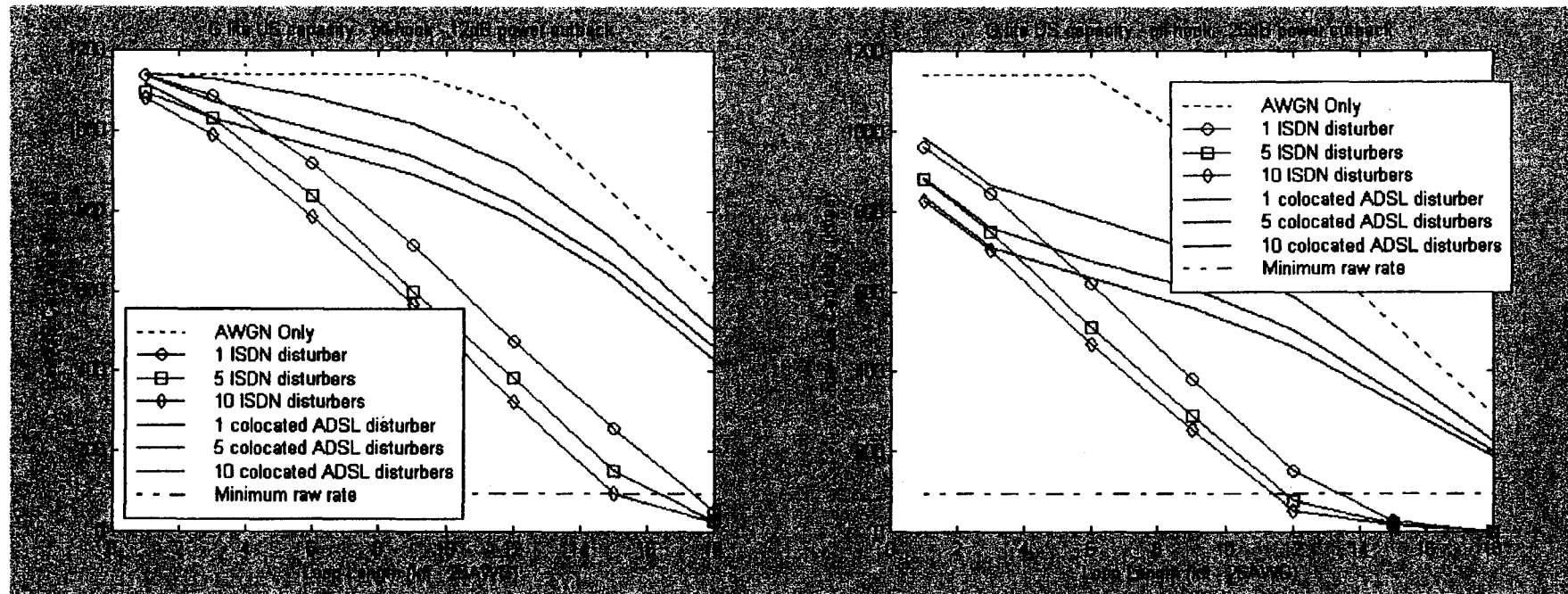
**Similar reference conditions are presented for off-hook splitterless operation (12dB US power cutback) and filterless operation (25dB cutback).**

# ISDN Disturber



**Upstream case shown is for on-hook and splintered operation  
where US transmitter is at full-power**

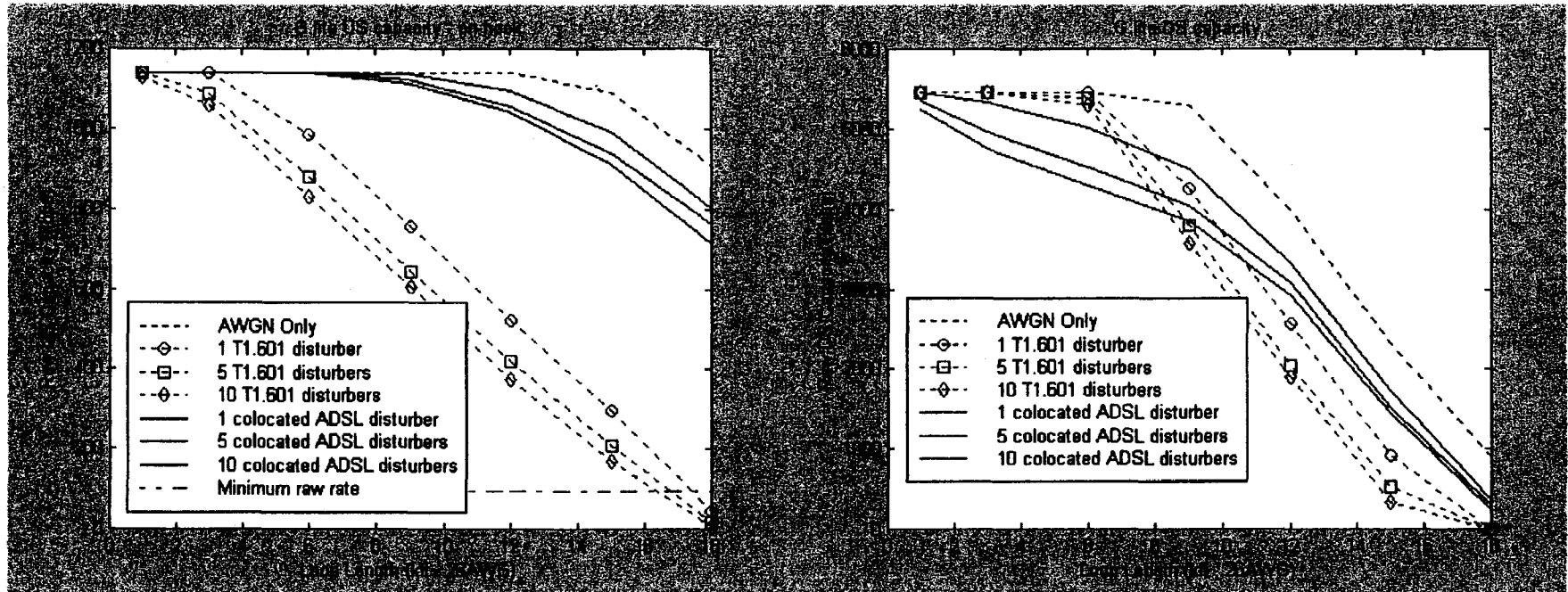
# ISDN Disturber - US power cutback



**Filterless operation will not be possible on some loops longer than ~11kft**

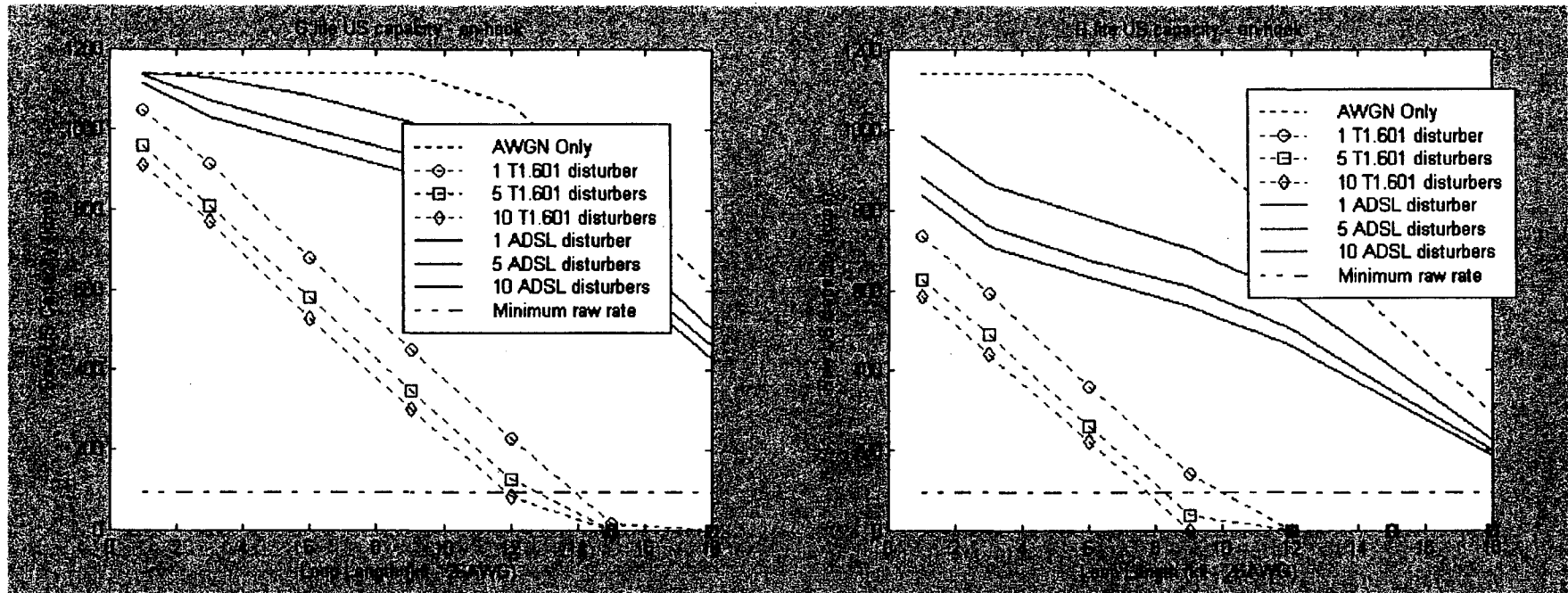
**Splitterless operation will not be possible on some loops longer than ~15kft**

# T1.601 Disturber



**Upstream case shown is for on-hook and splintered operation  
where US transmitter is at full-power**

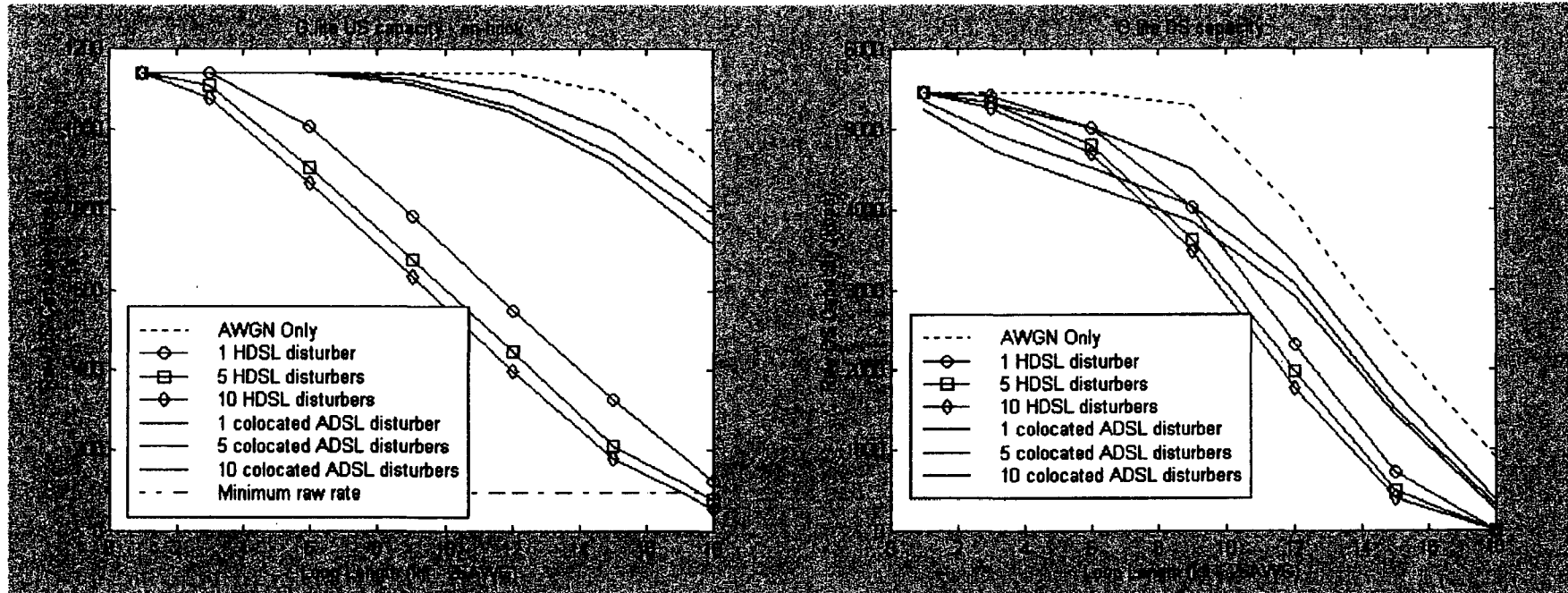
# T1.601 Disturber - US power cutback



**Filterless operation will not be possible on some loops longer than ~8kft**

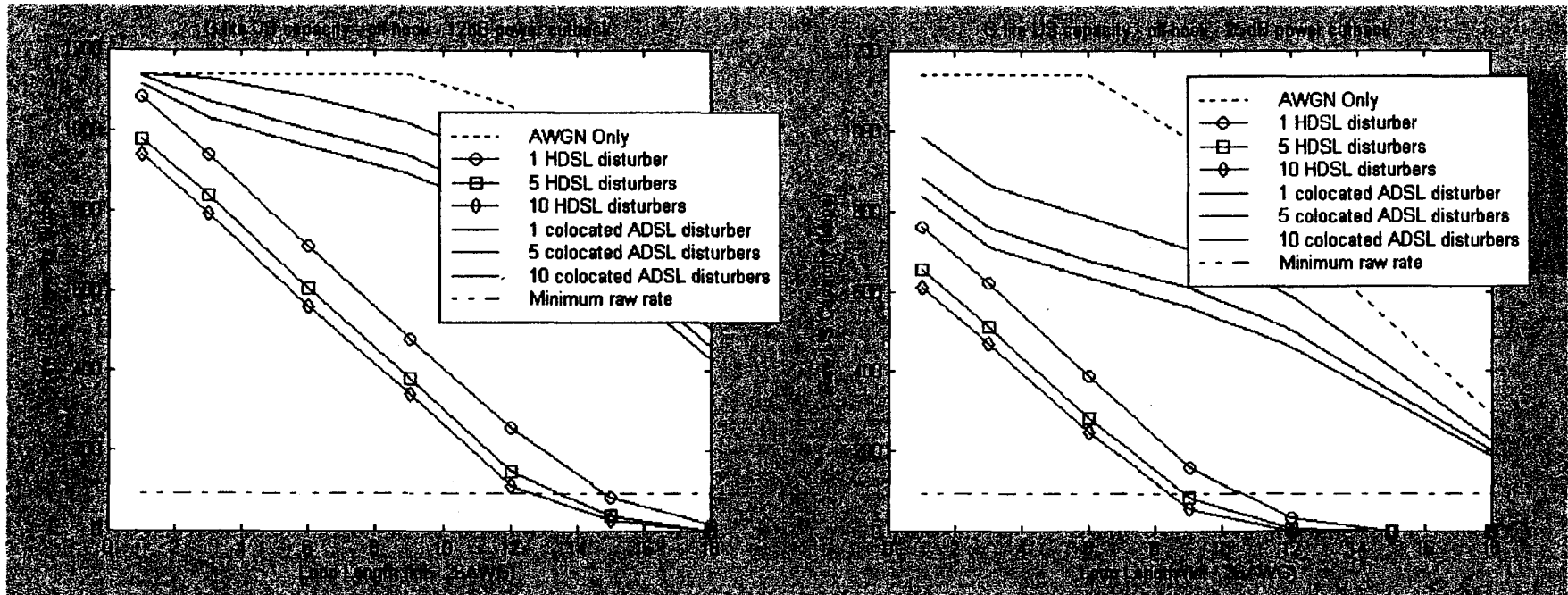
**Splitterless operation will not be possible on some loops longer than ~12kft**

# HDSL Disturber



**Upstream case shown is for on-hook and splintered operation where US transmitter is at full-power**

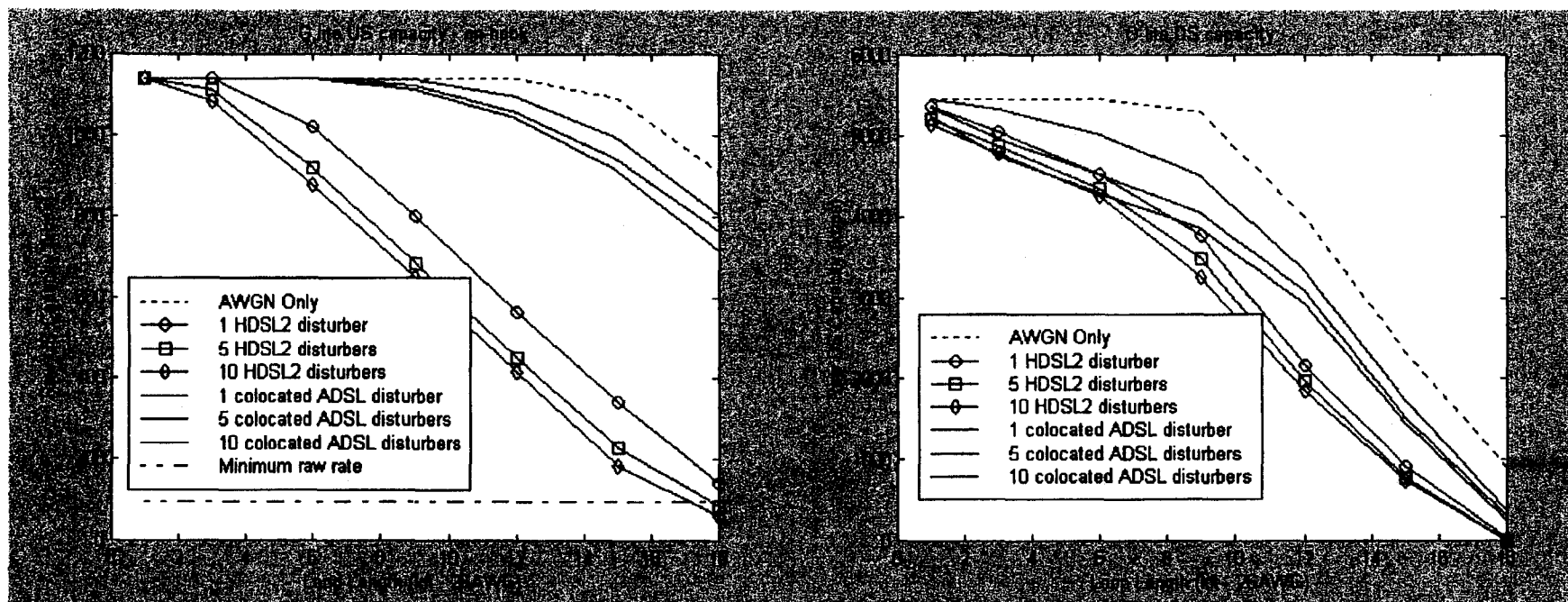
# HDSL Disturber - US power cutback



**Filterless operation will not be possible on some loops longer than ~8.5kft**

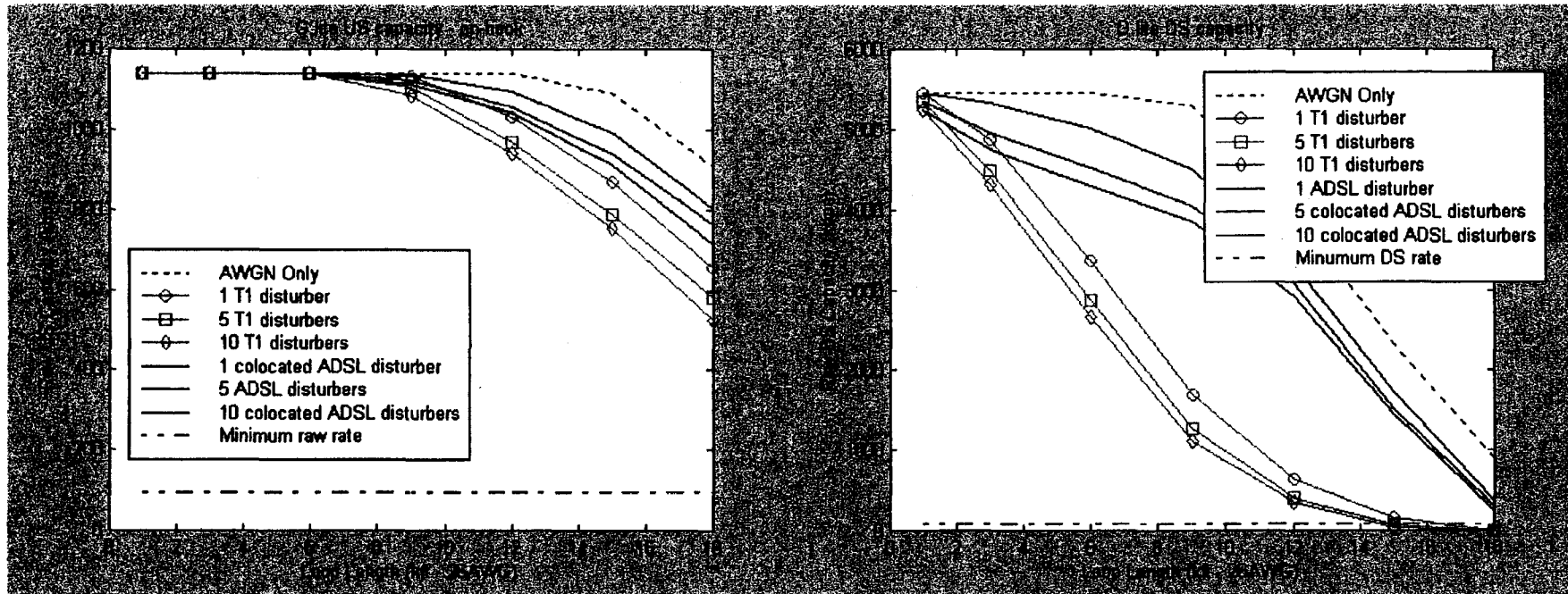
**Splitterless operation will not be possible on some loops longer than ~12.5kft**

# HDSL2 Disturber



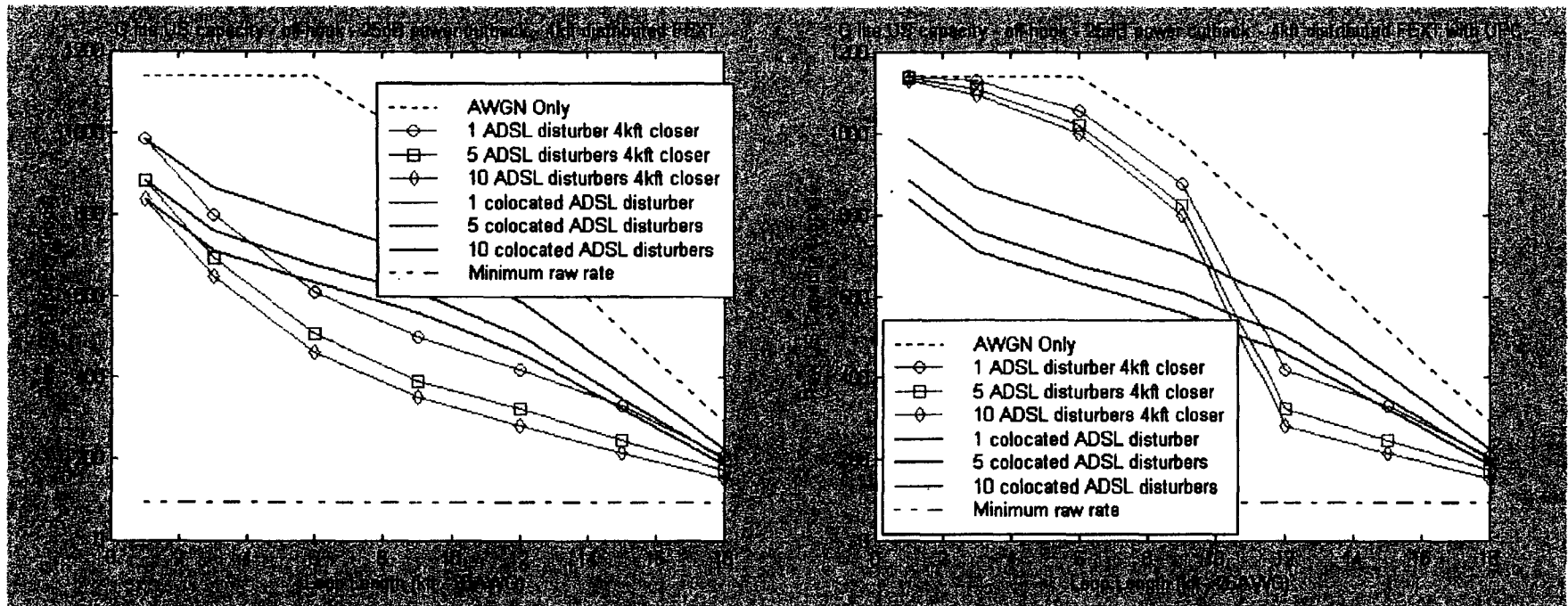
**Upstream case shown is for on-hook and splintered operation where US transmitter is at full-power**

# T1 Disturber



**Upstream case shown is for on-hook and splintered operation where US transmitter is at full-power**

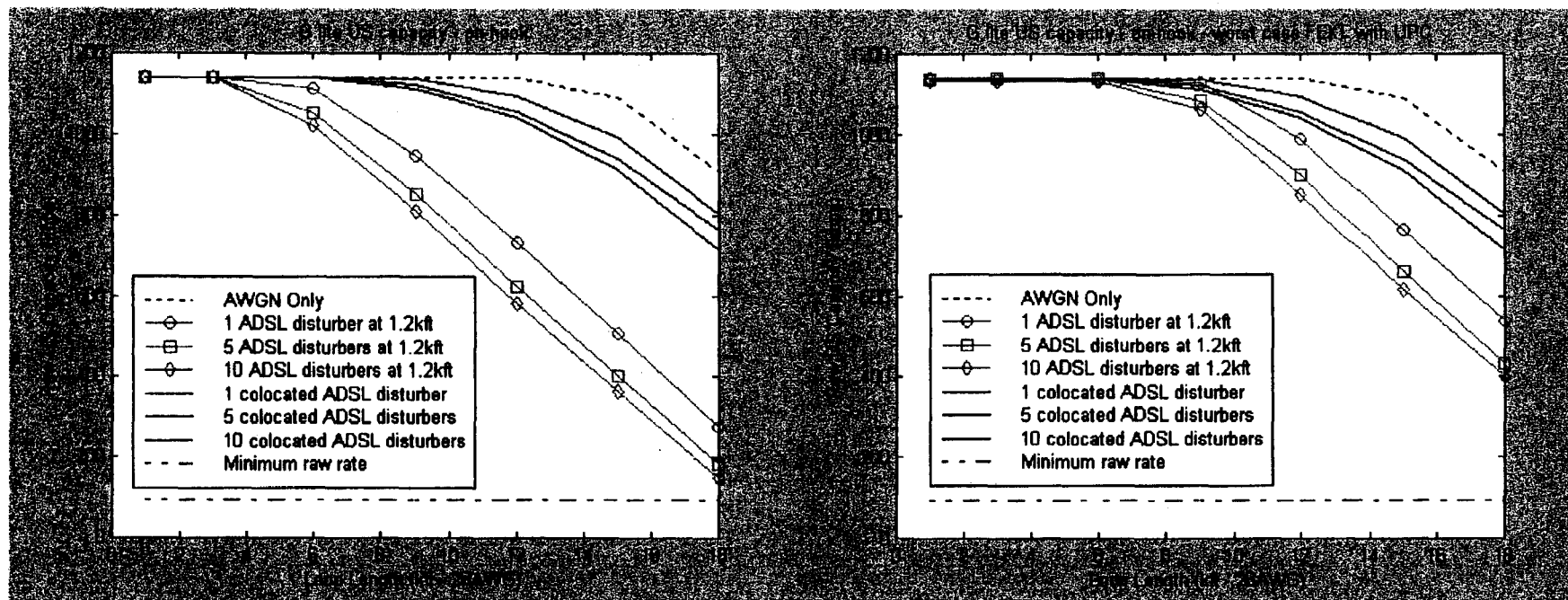
# Distributed FEXT ADSL - 25dB off-hook cutback **NORTEL NETWORKS**



**Using distributed FEXT model where ADSL (full-rate or G.lite) disturbers are 4kft closer to CO than victim system transmitter**

**Upstream power control on disturbing systems improves performance on loops shorter than 11kft.**

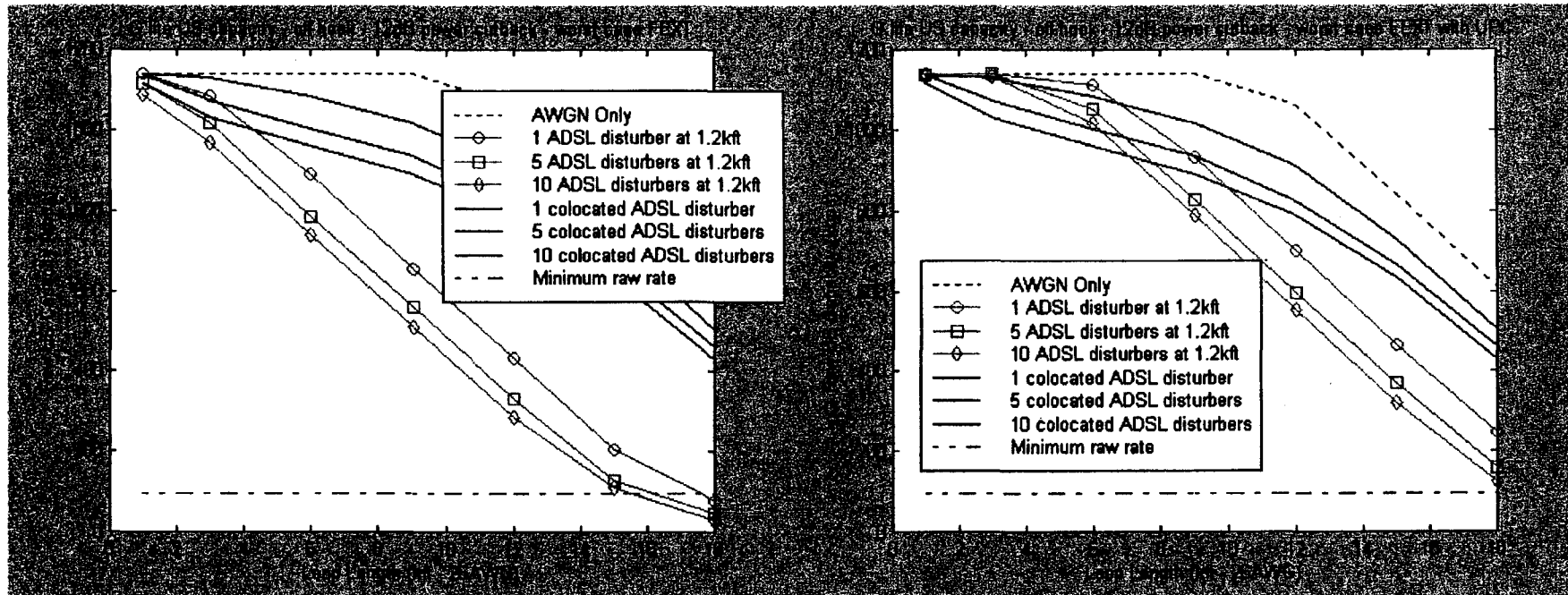
# Worst-case FEXT ADSL



**Using worst case FEXT model where ADSL (full-rate of G.lite) disturbers are at 1.2kft from CO (where FEXT power @80kHz is largest).**

**Upstream power control on disturbing systems improves performance on all loops longer than 3kft.**

# Worst case FEXT ADSL - 12dB off-hook cutback



Using worst case FEXT model where ADSL (full-rate or G.lite) disturbers are at 1.2kft from CO (where FEXT power @80kHz is largest).

Upstream power control on disturbing systems improves performance on all loops longer than 3kft.